ANNUAL REPORT 1964

FERGUS

water pollution control plant

DIVISION OF PLANT OPERATIONS

Ontario Water Resources Commission

ONTARIO WATER RESOURCES COMMISSION

OFFICE OF THE GENERAL MANAGER

Members of the Fergus Local Advisory Committee,
Town of Fergus.

Gentlemen:

We are pleased to provide you with the 1964 Operating Report for the Fergus Water Pollution Control Plant, OWRC Project No. 58-S-23.

By continuing the mutual cooperation which has existed in the past, we can look forward to greater progress in the field of water pollution control.

Yours very truly,

D. S. Caverly,
General Manager

General Manager
Ontario Water Resources Commission.

Dear Sir:

It is with pleasure that I present to you the Annual Report of the operation of the Fergus Water Pollution Control Plant, OWRC Project No. 58-S-23 for 1964.

This report presents design data, outlines operating problems encountered and summarizes in tables, charts and graphs all significant flow and cost data.

Yours very truly,

B. C. Palmer, P. Eng.,
Director,
Division of Plant Operations.

FOREWORD

This report describes the operation of this project for the year 1964. It includes a detailed description of the project, summary of operation, graphs and charts showing quality and quantity information, and project cost data.

This information will be of value to the municipality in assessing the adequacy of the works in meeting existing requirements and in projecting its capability to meet future expected demands. The cost information will be of particular interest to those concerned with developing and maintaining revenue structures.

The preparation of this report has been a cooperative effort of several groups within the Division of Plant Operations. These include the Statistical Section, Brochures Officer and the Regional Supervisor. However, the primary responsibility for the content has been with the Regional Operations Engineer. He will be pleased to discuss all aspects of this report with the municipality.

B. C. Palmer, P. Eng.,
Director,
Division of Plant Operations.

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FERGUS

water pollution control plant

operated for

THE TOWN OF FERGUS

by the

ONTARIO WATER RESOURCES COMMISSION

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Assistant Director: **C. W. Perry**
Regional Supervisor: **D. A. McTavish**
Operations Engineer: **B. G. Porter**

801 Bay Street **Toronto 5**

'64 REVIEW

The following report gives in detail significant data on the operation of the Fergus Water Pollution Control Plant.

1964 was a year of change in the methods and concepts of operation of the plant. Many of these changes, explained later in the report, were initiated by the serious odour problems that occurred during the summer months of the year. A reduction in the odour problems resulted, although at added cost to the plant operation. It is hoped that during 1965 odours can be controlled by the methods initiated during 1964.

The data contained in this report indicates that the plant is approaching rapidly its design hydraulic loading. The samples taken for BOD and suspended solids concentrations indicate that these are greater than the design values. During 1965, a more detailed study of the plant loading will be made to determine if overloading will create operating problems in the near future.

GLOSSARY

BOD	biochemical oxygen demand (a measure of organic content)
cfm	cubic feet per minute
comminution	shredding of solids into small fragments
DWF	dry weather flow
effluent	outflow
flocculation	bringing very small particles together to form a larger mass (the floc) before settling
fps	feet per second
gpcd	gallons per capita per day
gpm	gallons per minute
grit	sand, dust, stones, cinders and other heavy inorganic material
influent	inflow
lin. ft.	lineal feet
mgd	million gallons per day
mlss	mixed liquor suspended solids
ppm	parts per million
ss	suspended solids
TDH	total dynamic head (usually refers to pressure on a pump when it is in operation)

HISTORY
1958 - 1964

INCEPTION

In 1958, the Town of Fergus and the Ontario Water Resources Commission initiated plans for the construction of a modern water pollution control plant.

The firm of Proctor and Redfern, Consulting Engineers, Toronto, Ontario, was engaged to prepare plans and specifications for the project.

APPROVAL

On December 19, 1958, the Town of Fergus signed an agreement with the Ontario Water Resources Commission to finance, construct and operate the plant.

CONSTRUCTION

Canadian Engineering & Contracting Company of Hamilton, Ontario, began construction in 1959 and by the summer of 1959, the Division of Plant Operations had placed the plant in full operation.

TOTAL COST

$277,393.00.

Reg Ranton
Chief Operator

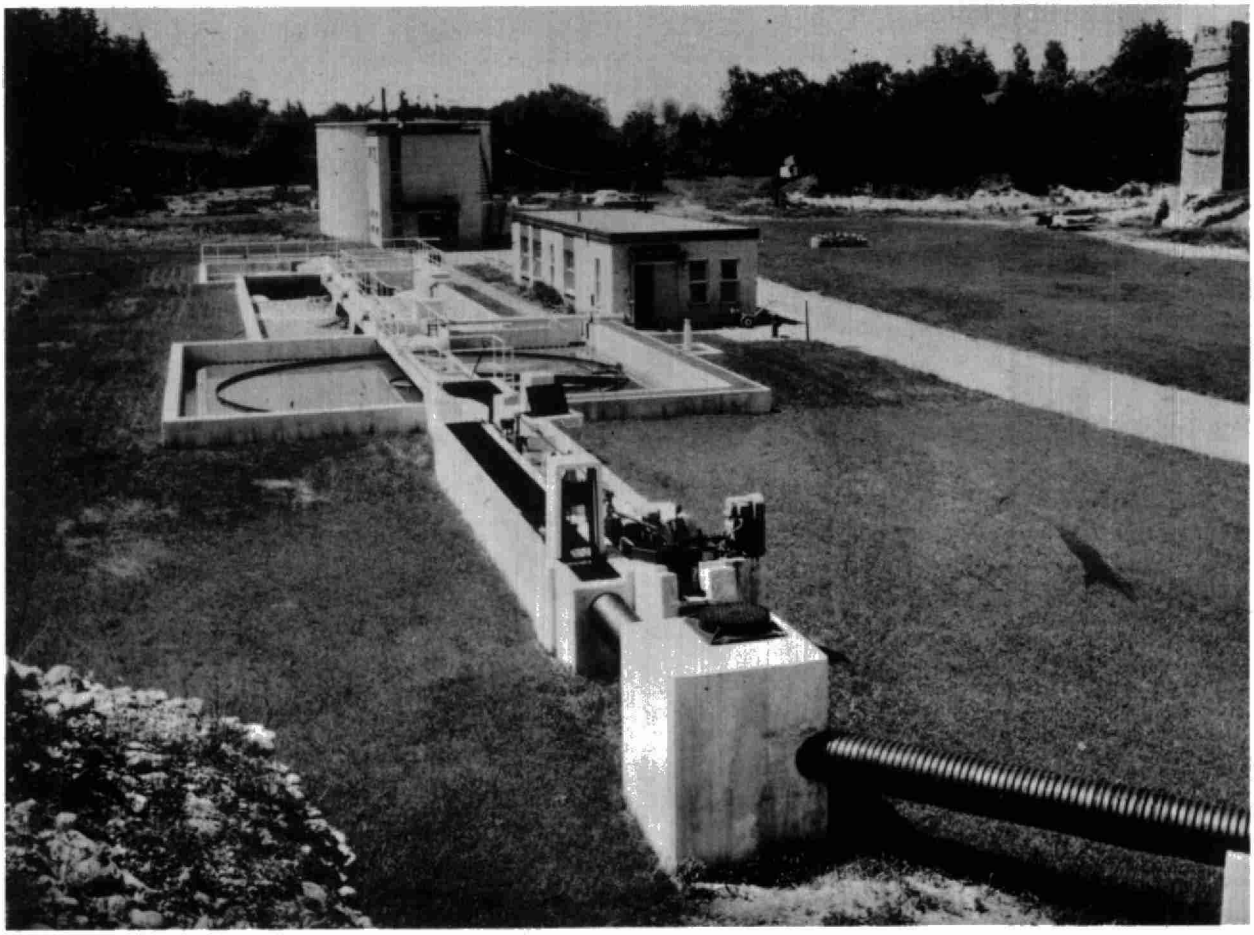
Project Staff

Operator: Art Carlaw

COMMENTS

Mr. Reg Ranton took over as Chief Operator on October 21, 1964, following the resignation of Mr. Roy Bridge.

The plant is staffed by the Chief Operator and one operator. This provides a coverage of 10 hours a day when both are in the plant. Two one-hour inspections per day are made on Saturday and Sunday mornings.



Description of Project

RAW SEWAGE

Sewage enters the plant site via an 18 inch sewer. It is coarse screened before passing through a barminutor which is designed to cut and shred the larger solids in the sewage. Sand and grit is then removed by a Dorr-Oliver Type T detritor. This unit has a manually cleaned bypass channel to facilitate repairs. After grit removal, the raw sewage passes through a 6 inch Parshall flume connected to a metering device which records the rate of flow and total flow for each day.

Storm flow in excess of about 1 MGD by-passes the influent works and is directed through two formerly existing septic tanks and the chlorine contact chamber before discharging to the river.

PRIMARY SEDIMENTATION TANK

Primary sedimentation is provided by one 40' square concrete tank with a 9' side wall depth equipped with a Dorr-Oliver rotary scraper mechanism. A detention time of 3.6 hours at design flow is provided. Flow in excess of 0.9 MGD is by-passed to the effluent sewer.

The function of this tank is to remove the organic solids that will settle or float. Scraping mechanisms collect this "raw sludge" which is pumped to the digestion tank.

AERATION

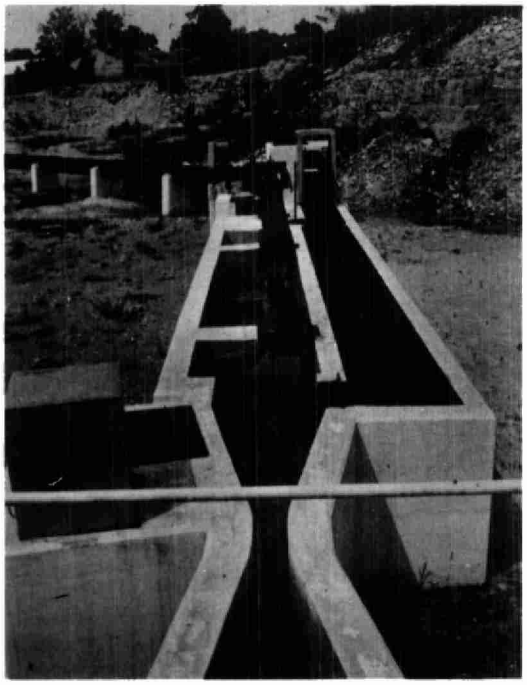
The aeration tank consists of three units each 24' square with a 10'8" side wall depth. A retention time of 4.41 hours is provided at the design flow of 0.6 MGD.

Air is supplied by 'Simplex" mechanical aerators; each unit is provided with one of these high intensity aerators.

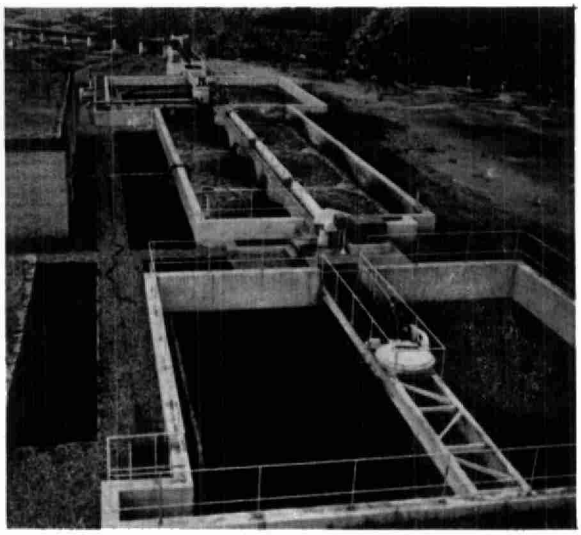
FINAL SEDIMENTATION TANK

The aerated mixed liquor is retained for approximately 2.2 hours in a 35' square concrete final sedimentation tank with a 9' SWD. Activated sludge containing the solids absorbed by bacterial action in the aeration section settles out in this tank. A Dorr-Oliver rotary scraper mechanism is used to collect the sludge part of which is returned to the head of the aeration section for continued bacterial action and part of which is wasted to the digester.

The liquid which flows over the final clarifier weir plate is chlorinated in the chlorine contact chamber and flows to the river as plant effluent.



INFLUENT WORKS



AERATION TANK

SLUDGE DIGESTION TANK

Single stage digestion is provided by the 35 ft. diameter and 22 ft. deep digester tank. This 22,700 cubic feet capacity digester is equipped with Dorr-Oliver floating cover and a draft tube mixer. The sludge is heated to the required temperature for digestion by a Pacific Flush Tank Company heat exchanger which is located in the digester building.

Methane gas is stored under the floating cover and us used as fuel.

The digested sludge may be directed to sand beds for drying and later disposed of on local farms as a soil conditioner. The drying beds have a total area of 7,200 sq. ft.

In 1964, provision was made for liquid sludge haulage with the result that the drying beds will not be used in the future. The liquid digested sludge is also used as a soil conditioner.

CHLORINATION

Plant effluent is chlorinated in this chamber from a 200 lb/24 hours capacity Builders Providence gas chlorinator.

The contact chamber gives a contact time of 15 minutes.

PROJECT COSTS

TOTAL CAPITAL COST:	$281,660.99

The total cost to the municipality during 1964 was as follows:

Net Operating	$ 19,881.89
Debt Retirement	10,064.00
Reserve	2,200.00
Interest Charged	15,606.27
TOTAL	$ 47,752.16

RESERVE ACCOUNT

Balance at January 1, 1964	$ 8,425.32
Deposited by Municipality	2,200.00
Interest Earned	511.09
	$ 11,136.41
Less Expenditures	726.84
Balance at December 31, 1964	$ 10,409.57

LONG TERM DEBT: The municipality's long term debt to the OWRC, revised December 31, 1964, was $277,393.

MONTHLY COSTS

MONTH	TOTAL EXPENDITURE	PAYROLL	CASUAL PAYROLL	FUEL	POWER	CHEMICAL	GENERAL SUPPLIES	EQUIPMENT	REPAIRS & MAINTENANCE	SUNDRY	WATER
JAN	1282.31	623.72			87.00		43.25		406.03		122.31
FEB	1210.80	623.72		90.26	199.56	224.03	55.43		3.32	14.48	
MARCH	869.57	623.72		100.88	76.08		42.55			26.34	
APRIL	934.55	719.20			82.55		9.02			9.48	114.30
MAY	1749.27	972.33		78.93	79.33	294.03	25.97	88.05	190.15	20.48	
JUNE	1269.95	726.72			97.94		104.14	323.49		17.66	
JULY	2245.71	727.43			108.85	411.49	60.03	514.44	75.98	240.03	107.46
AUG	2578.06	719.55			(0.80)	93.77	67.92	416.79	67.30	1213.53	
SEPT	1313.70	648.20			109.39	84.03	76.64		100.09	295.35	
OCT	2880.21	543.84			113.85	574.03	21.58	(162.00)	99.73	1480.29	208.89
NOV	556.10	676.85			118.30	(350.00)	40.33		47.27	23.35	
DEC	2991.66	1018.59		101.89	112.67	(195.97)	200.37	37.56	692.35	1024.20	
TOTAL	19881.89	8623.87		371.96	1184.72	1135.41	747.23	1218.33	1682.22	4365.19	552.96

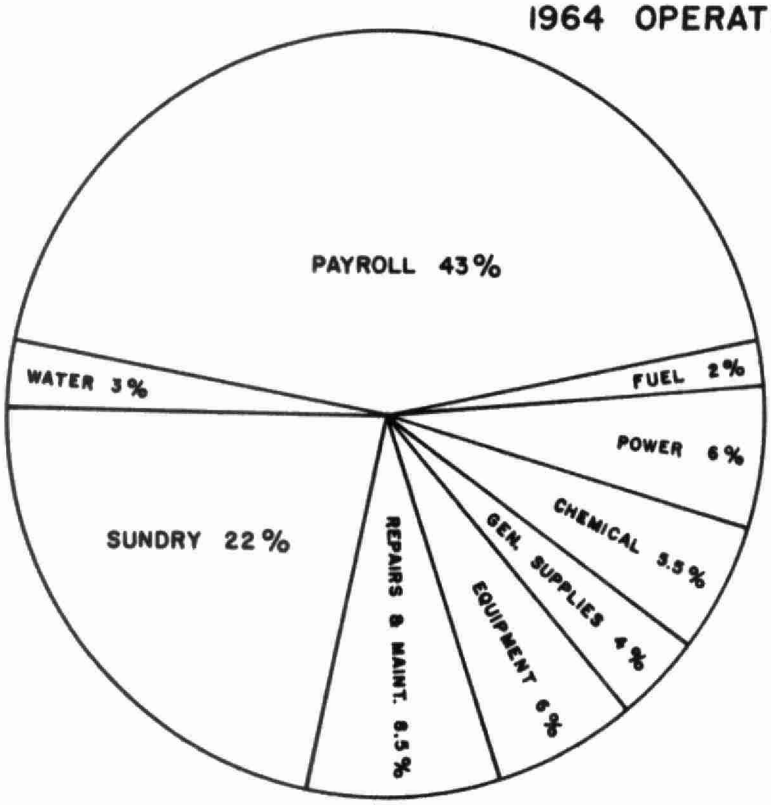
BRACKETS INDICATE CREDIT

YEARLY COSTS

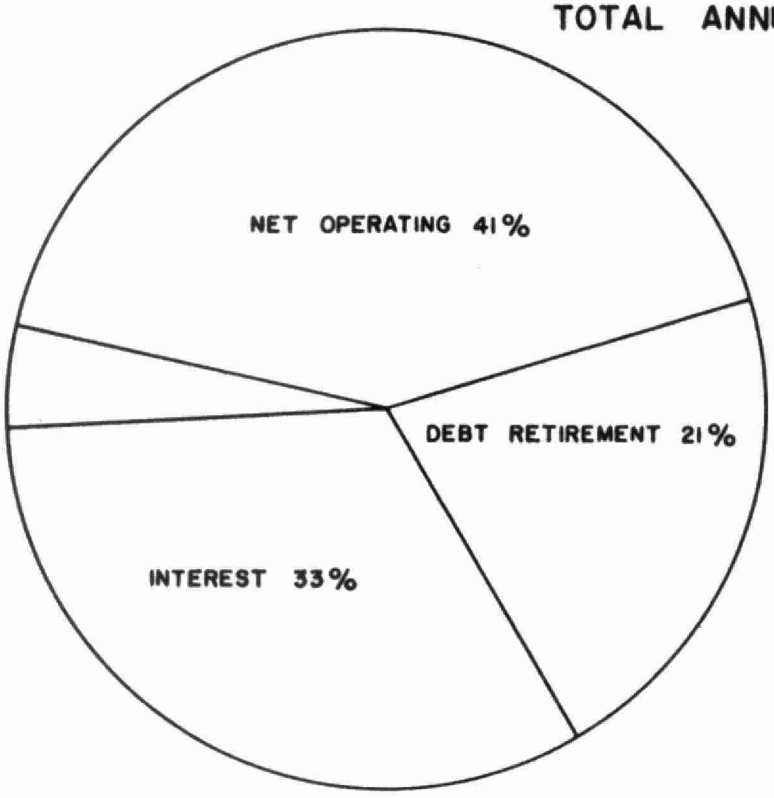
YEAR	M.G. TREATED	TOTAL COST	COST PER FAMILY PER YEAR	COST PER MILLION GALLONS	COST PER L.B. OF BOD REMOVED
1961	118.82	11,201.00	*11.04	94.25	6 CENTS
1962	106.77	12,021.00	11.86	112.50	4 CENTS
1963	143.12	12,730.66	12.56	88.83	5 CENTS
1964	180.12	19,881.89	19.19	110.37	4 CENTS

* BASED ON ANNUAL POPULATION ESTIMATE AND 3.9 PERSONS PER FAMILY

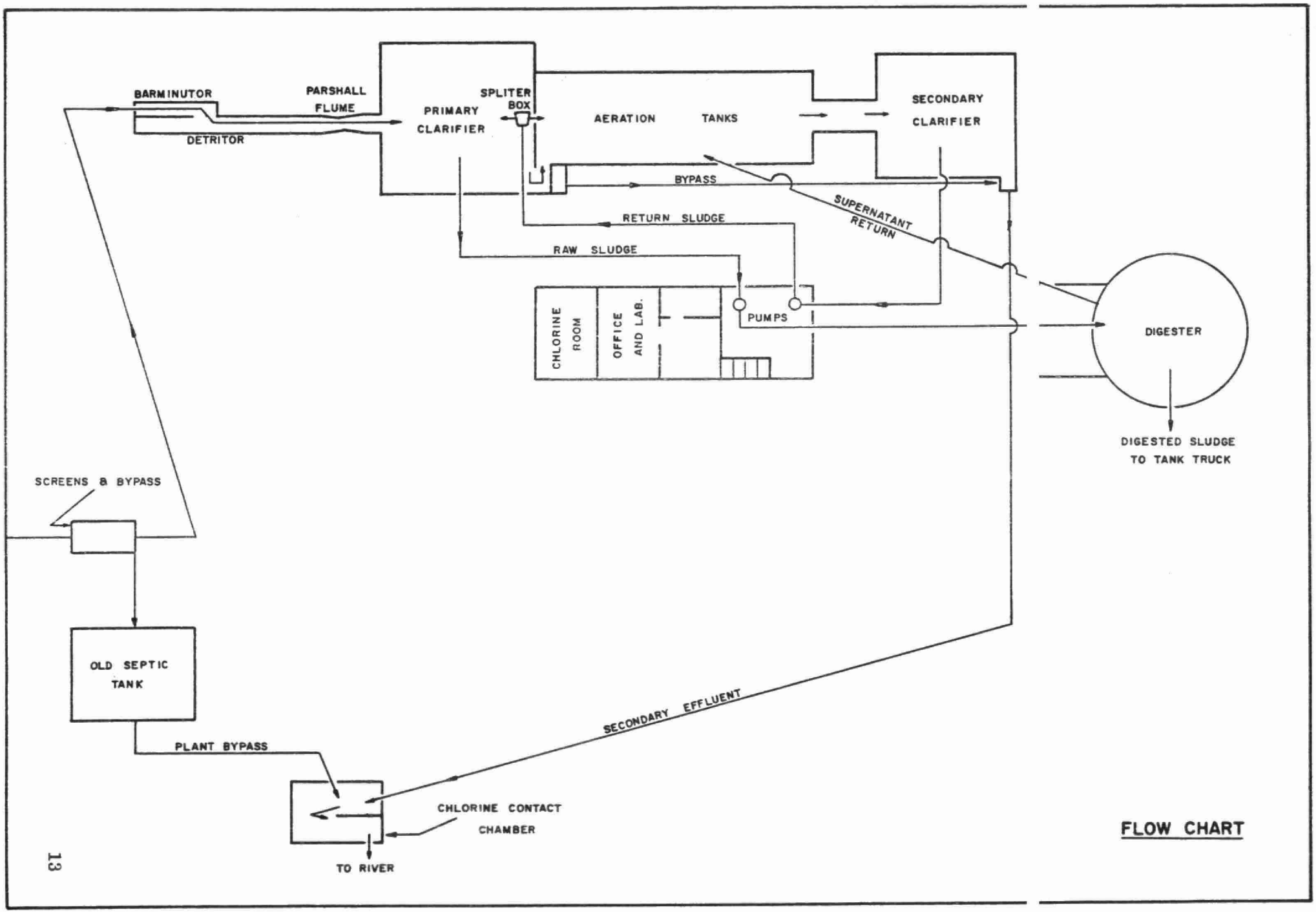
1964 OPERATING COSTS



TOTAL ANNUAL COST



Technical Section


BARMINUTOR
PARSHALL FLUME
DETRITOR
PRIMARY CLARIFIER
SPLITER BOX
AERATION TANKS
SECONDARY CLARIFIER
BYPASS
SUPERNATANT RETURN
RETURN SLUDGE
RAW SLUDGE
CHLORINE ROOM
OFFICE AND LAB.
PUMPS
DIGESTER
DIGESTED SLUDGE TO TANK TRUCK
SCREENS & BYPASS
OLD SEPTIC TANK
PLANT BYPASS
SECONDARY EFFLUENT
CHLORINE CONTACT CHAMBER
TO RIVER
FLOW CHART

Design—Data

GENERAL

Type of Plant - Activated sludge.

Design Population - 4,700

Design Plant Flow - 0.6 MGD.

Per Capita Flow - 128 IGPD.

Five Day BOD -

Raw Sewage	-	200 PPM
Removal	-	90%

Suspended Solids -

Raw Sewage	-	200 PPM
Removal	-	90%

PRIMARY TREATMENT

Grit Removal

Dorr-Oliver Type T Detritor

Screening

18" Chicago model "B" barminutor.

Primary Sedimentation Tank

One - 40' square tank with circular mechanical sludge removal facilities.

AERATION SECTION

One - Size - 24' x 72' x 10'7" SWD.

Volume - 22,080

AERATION SECTION - Continued

Retention - 4.41 hours @ 0.6 MGD.

Type - Simplex Mechanical Aerators - Ames Crosta.

FINAL SEDIMENTATION TANK

One - Size - 35' square x 9' SWD equipped with Dorr-Oliver rotary scraper.

Volume - 11,025 cubic feet.

Retention - 2.2 hours @ 0.6 MGD and 25% return sludge.

CHLORINE CONTACT CHAMBER

One - volume - 911 cubic feet.

Retention - 15 minutes at design.

Capacity - 200 pounds per 24 hours.

DIGESTION SYSTEM

One - heated primary digester.

Size - 35' diameter x 22' SWD.

Volume - 22,700 cubic feet.

Capacity - 4.8 cubic feet per capita.

Dorr-Oliver floating cover.

Draft tube mixer..

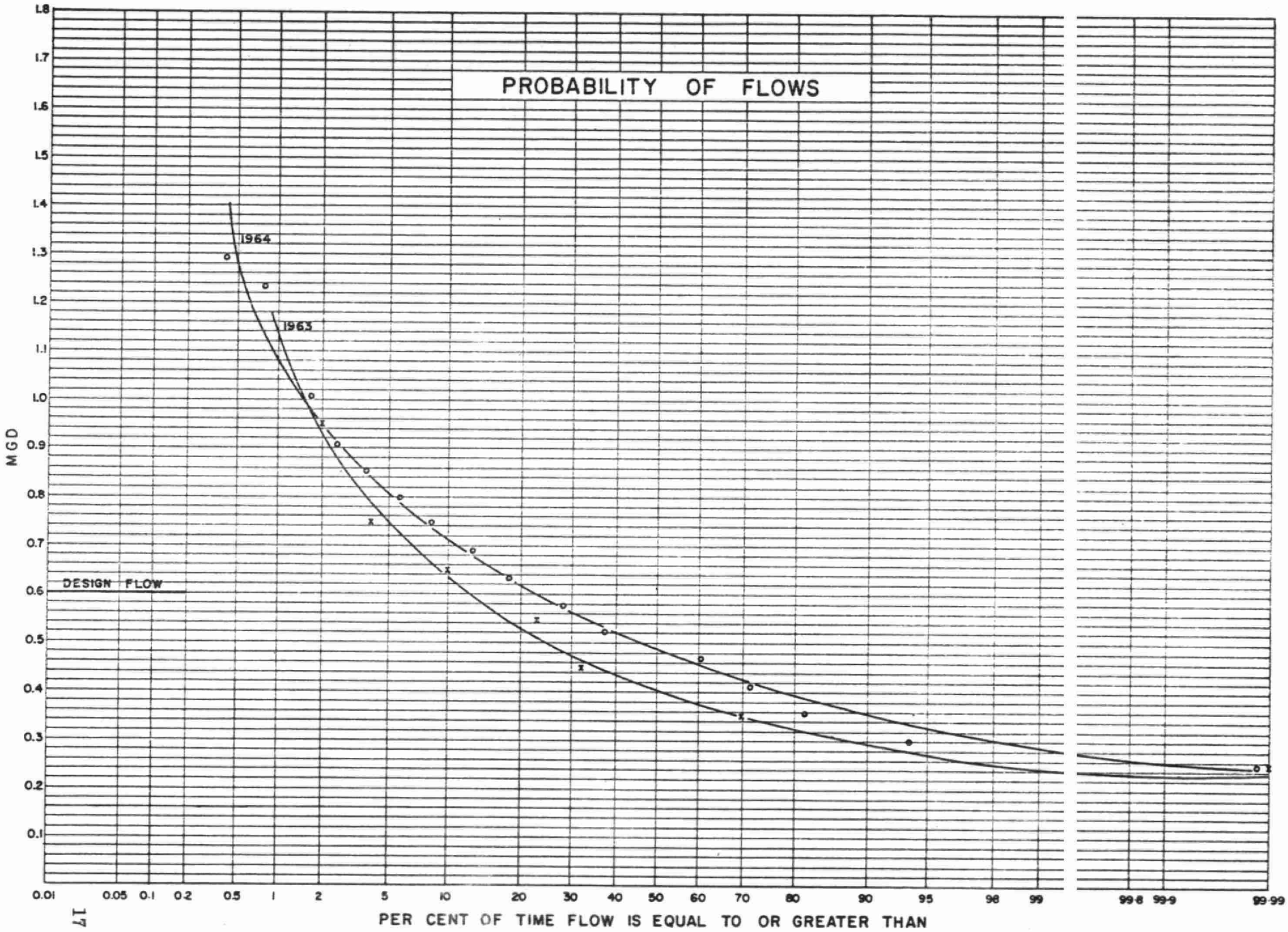
Process Data

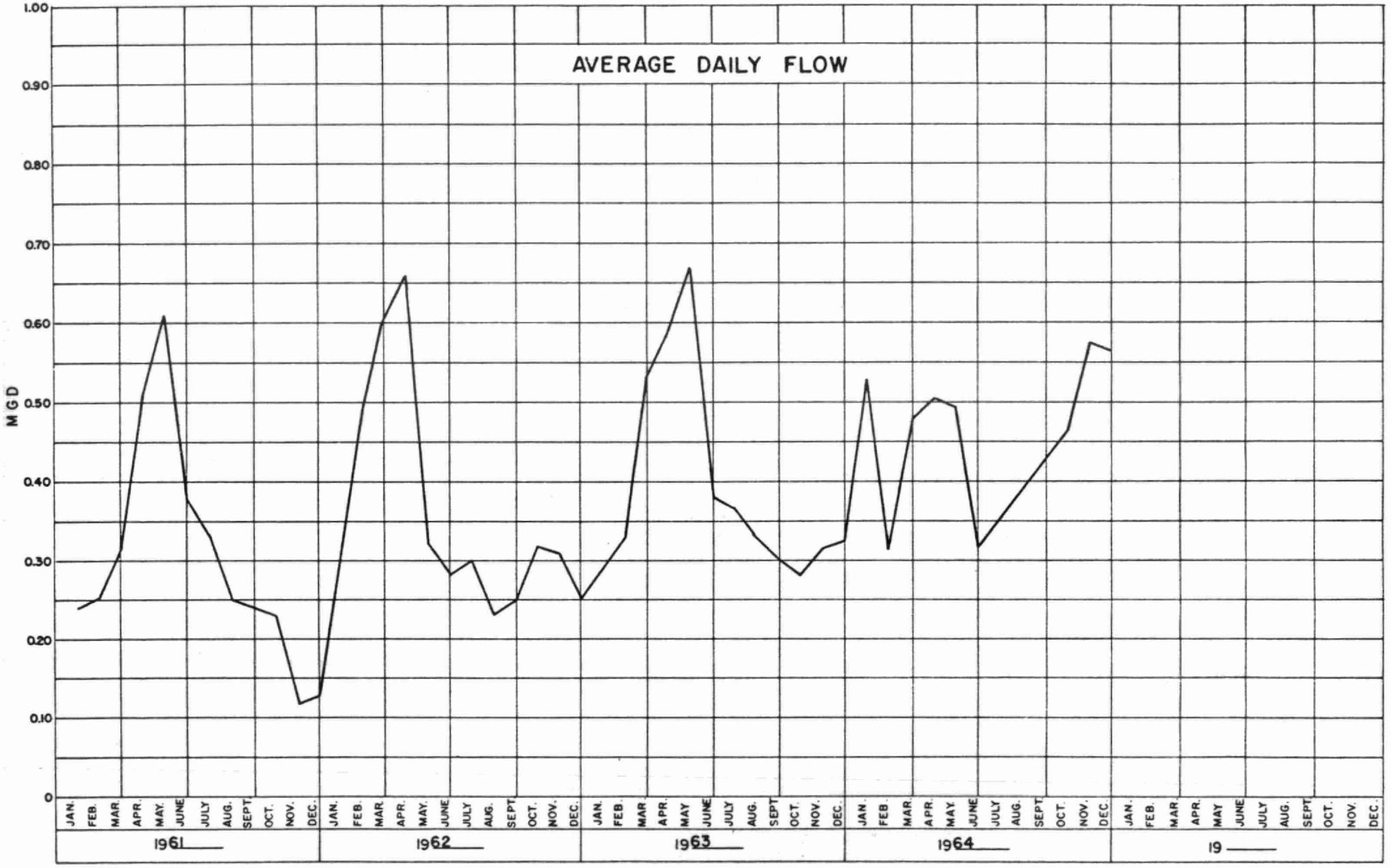
The average daily flow and total flow for the year were higher than the 1963 flows. During 1964, the average daily flow was .494 million gallons as compared to 0.392 million gallons in 1963. This is an increase of about 26%. The 1963 flows increased about 34% over 1962. If this trend is continued, the average flow in 1965 will be 0.6 MGD or the design flow of the plant.

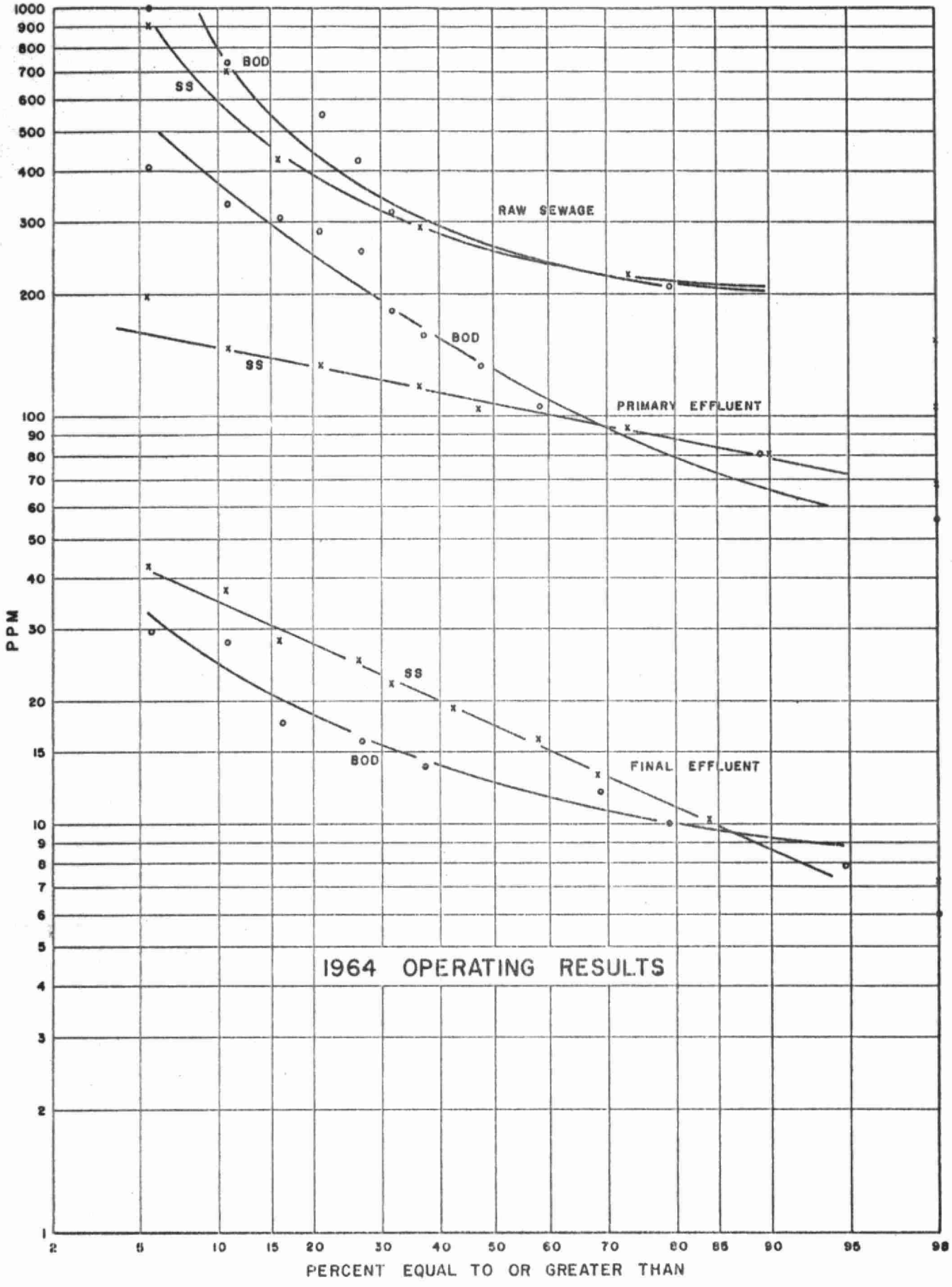
During the year 180 million gallons of combined industrial and domestic flow received complete treatment.

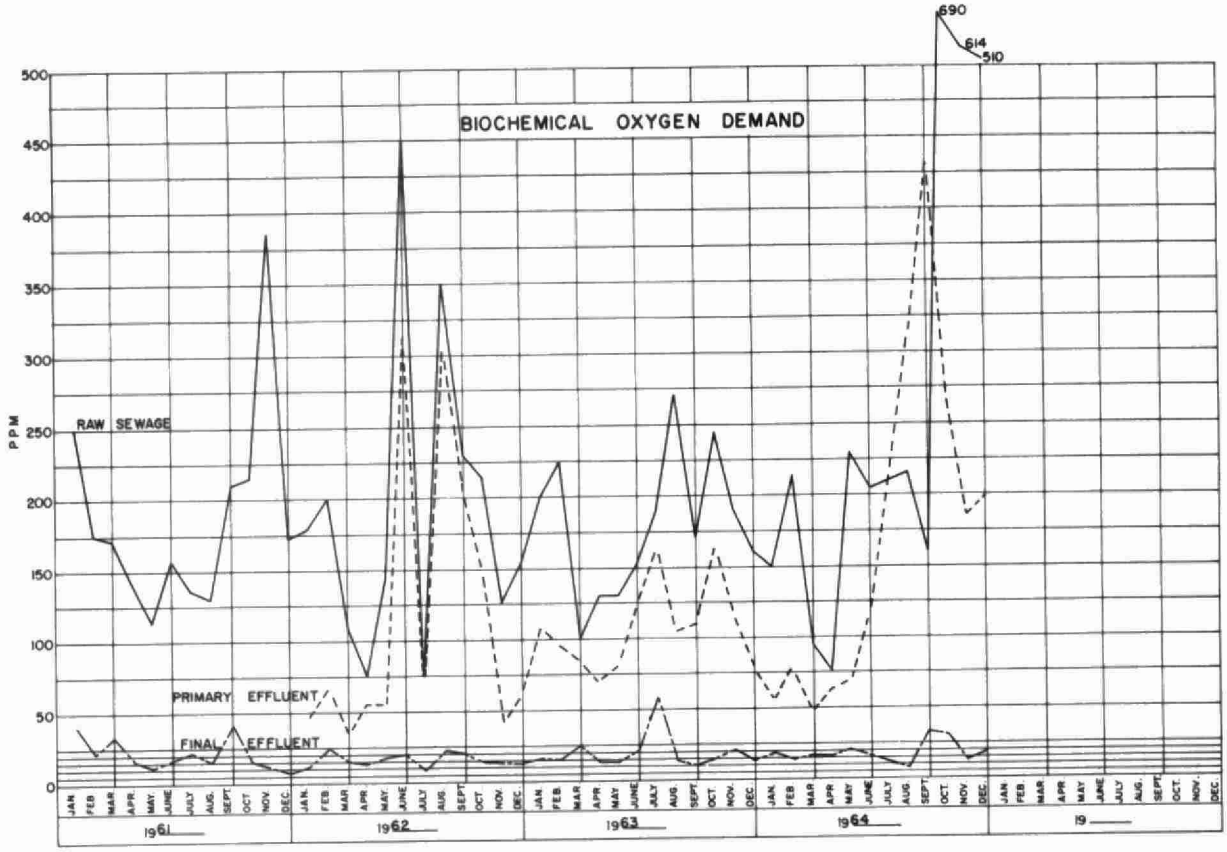
The maximum 24 hour recorded flow was 1.31 million gallons, and the maximum rate recorded was 1.9 million gallons per day. These high flows occurred during the spring. A plant by-pass is designed to divert part of the flow through the old sedimentation tanks for flow rates in excess of 1.0 MGD. This by-passed flow receives chlorination in the chlorine contact chamber before discharging to the river.

The following probability graph indicates the variation in flow which occurred during the year. Approximately 22% of the time, the flows were greater than the design flow of 0.6 MGD. In 1963, the design flow was exceeded only 13% of the time.

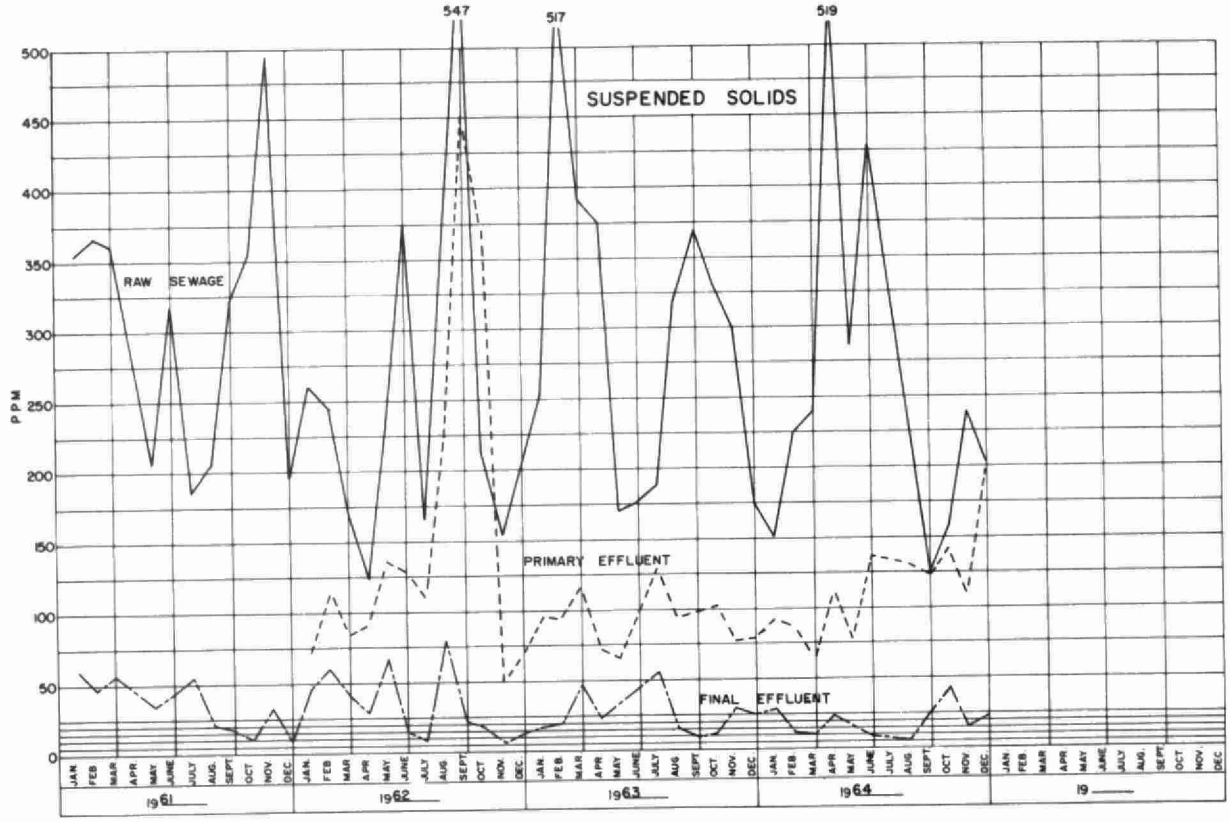

PROBABILITY OF FLOWS
1964
1963
DESIGN FLOW
MGD
1.8
1.7
1.6
1.5
1.4
1.3
1.2
1.1
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.01
0.05
0.1
0.2
0.5
1
2
5
10
20
30
40
50
60
70
80
90
95
98
99
99.8
99.9
99.99
PER CENT OF TIME FLOW IS EQUAL TO OR GREATER THAN


AVERAGE DAILY FLOW
MGD
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0
JAN. FEB. MAR. APR. MAY. JUNE JULY AUG. SEPT OCT. NOV. DEC.
1961
1962
1963
1964
19


1000
900
800
700
600
500
400
300
200
100
90
80
70
60
50
40
30
20
15
10
9
8
7
6
5
4
3
2
1
PPM
BOD
SS
RAW SEWAGE
BOD
SS
PRIMARY EFFLUENT
SS
BOD
FINAL EFFLUENT
1964 OPERATING RESULTS
2
5
10
15
20
30
40
50
60
70
80
85
90
95
98
PERCENT EQUAL TO OR GREATER THAN



MONTHLY VARIATIONS



GRIT, B.O.D AND S.S. REMOVAL

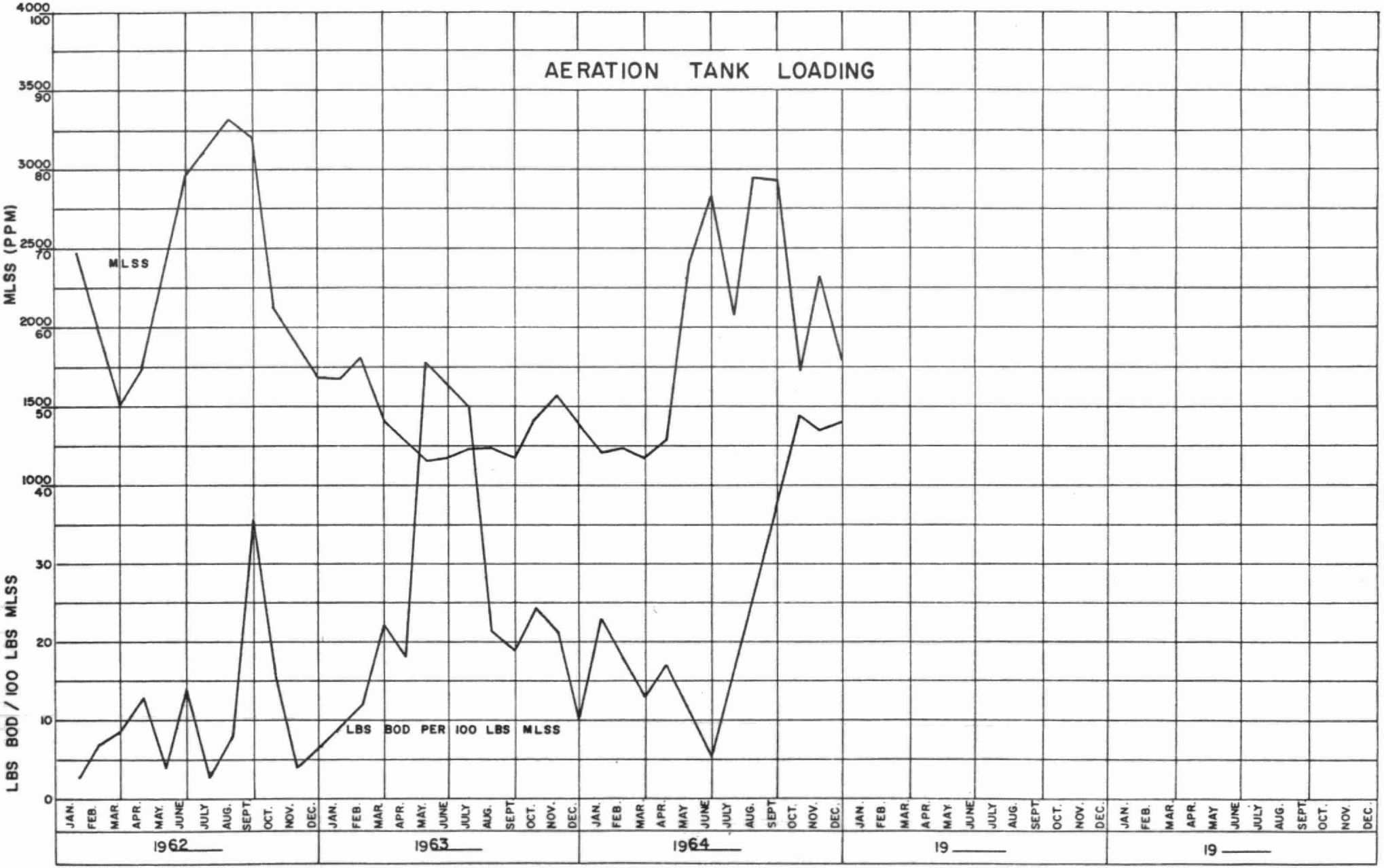
MONTH	B. O. D.				S. S.				GRIT REMOVAL CU. FT.
	INFLUENT P.P.M.	EFFLUENT P.P.M.	% REDUCTION	TONS REMOVED	INFLUENT P.P.M.	EFFLUENT P.P.M.	% REDUCTION	TONS REMOVED	
JAN.	150	14	90.5	11.1	152	28	81.5	10.2	2
FEB.	215	9.4	95.5	9.3	223	12	94.5	9.6	5
MAR.	94	12	87	6.2	242	11	95.5	17.4	5
APR.	76	12	84	4.8	519	23	95.5	37.5	8
MAY	230	16	93	16.5	286	16	94.5	20.8	6
JUNE	205	10.8	94.5	14.3	428	9	98	30.9	6
JULY	*289	14.5	95.0	20.9	262	19	92.5	18.5	11
AUG.	240	4.8	98.0	17.9	226	5	97.5	16.8	25.5
SEPT.	160	29.0	82.0	9.7	124	26	97.0	7.2	5
OCT.	690	27.0	96.0	47.5	160	43	73.0	8.4	16
NOV.	614	11.0	98.0	51.8	316	14	95.5	25.9	22
DEC.	510	13.0	97.5	43.6	202	22	89.0	15.9	44
TOTAL	-	-	-	247.2	-	-	-	234.2	155.5
AVG.	289	14.5	95.0	20.6	262	19	92.5	19.5	13.0

* Average value substituted
No sample taken

COMMENTS

The average BOD and suspended solids concentrations exceeded the design value of 200 ppm. The BOD loading was exceptionally high during the last three months of 1964. The average BOD in the final effluent just met the OWRC objective of 15 ppm and exceeded this value 32% of the time. The suspended solids concentration in the final effluent was above the OWRC objective 60% of the time.

Should the high BOD loadings continue into the summer of 1965, odour problems can be anticipated from the raw sewage. The source of this high BOD should be eliminated in order to reduce the possibility of odours and also to extend the useful life of the plant. Pre-chlorination at the source or other point remote from the treatment plant may be necessary.

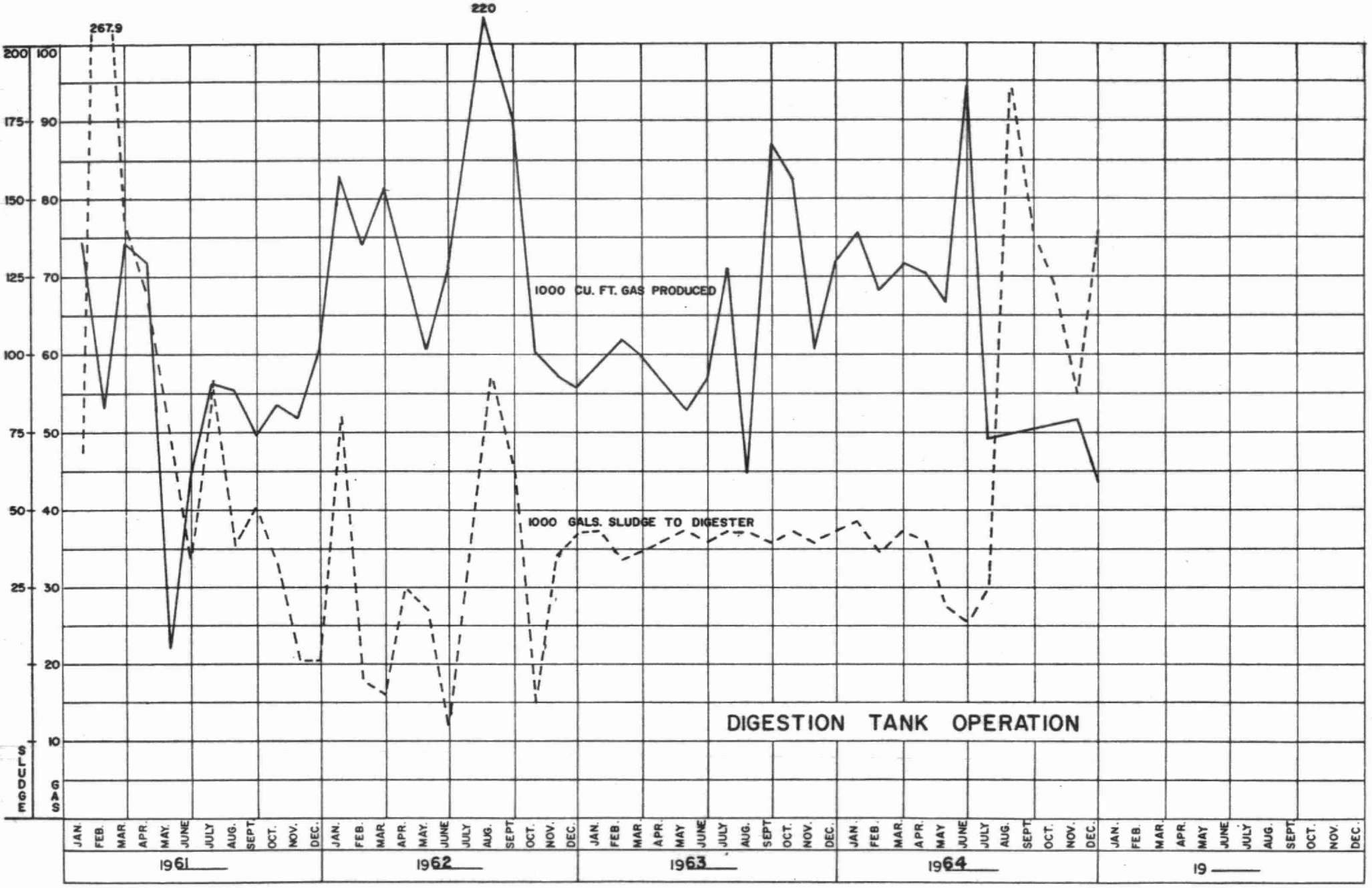

AERATION TANK LOADING
MLSS (PPM)
LBS BOD / 100 LBS MLSS
MLSS
LBS BOD PER 100 LBS MLSS
4000
3500
3000
2500
2000
1500
1000
100
90
80
70
60
50
40
30
20
10
0
JAN. FEB. MAR. APR. MAY. JUNE JULY AUG. SEPT OCT. NOV. DEC.
1962
1963
1964
19
19

AERATION SECTION

MONTH	PRIM. EFFL. B.O.D. P.P.M.	M.L.S.S. P.P.M.	LBS. B.O.D. PER 100 LBS. M. L. S. S.	CUBIC FEET AIR PER LB. B.O.D. REMOVED
JANUARY	82	1414	23	-
FEBRUARY	103	1478	17	-
MARCH	49	1186	13	-
APRIL	64	1294	17	-
MAY	70	2406	11	-
JUNE	117	2863	5	-
JULY	-	2098	-	-
AUGUST	335	2947	-	-
SEPTEMBER	430	2940	-	-
OCTOBER	265	1732	49	-
NOVEMBER	250	2328	47	-
DECEMBER	198	1793	48	-
TOTAL	-	-	-	-
AVERAGE	178	2040	26	-

COMMENTS

Mechanical aeration is employed at Fergus. The quantity of air supplied by these aerators can be theoretically estimated, but cannot be established from day to day as it can with conventional diffused air aeration. The available dissolved oxygen in the aeration effluent indicates, however, that sufficient air supplies are available for efficient operation of this section of the plant. It is fortunate that this equipment has been capable of supplying enough air to treat the stronger than design sewage recently entering the plant.


267.9
220
1000 CU. FT. GAS PRODUCED
1000 GALS. SLUDGE TO DIGESTER
DIGESTION TANK OPERATION
MCUFT GAS
200
175
150
125
100
75
50
25
100
90
80
70
60
50
40
30
20
10
JAN. FEB. MAR. APR. MAY. JUNE JULY AUG. SEPT OCT. NOV. DEC.
1961
1962
1963
1964
19

DIGESTER OPERATION

MONTH	SLUDGE TO DIGESTERS			SLUDGE FROM DIGESTERS			GAS PRODUCED 1000'S Cu. Ft.
	1000'S CU.FT.	% SOLIDS	% VOL. MAT.	1000'S CU.FT.	% SOLIDS	% VOL. MAT	
JAN.	6.15	4.20	-	3.60	-	-	138.26
FEB.	5.58	3.80	-	2.88	2.47	-	120.78
MAR.	5.96	1.42	-	3.60	-	-	129.41
APR.	5.77	2.66	-	5.61	2.48	-	125.93
MAY	4.42 +	3.90	-	1.92	-	-	117.33
JUNE	4.09 +	4.75	3.50	3.20	-	-	185.32
JULY	4.81	-	-	17.95	-	-	71.95
AUG.	15.05	2.04	-	13.62	-	-	*
SEPT.	12.12	4.70	-	10.58	-	-	*
OCT.	11.03	2.57	-	11.72	-	-	*
NOV.	8.79	1.34	-	12.31	-	-	*79.44
DEC.	12.19	1.90	-	9.23			58.17
TOTAL	95.96	-	-	96.22	-	-	** 1368.80
AVG.	8.00	3.02	3.50	8.02	2.48	-	114.07

* meter out of service
** prorated on 9 months' data.

COMMENTS

A total of 95,960 cubic feet of raw sludge was pumped to the digester, and a total of 96,220 cubic feet of supernatant and digested sludge was removed. These values, having been calculated from pump running times and rough volume measurement, are not considered to be exact. Due to new equipment these values will be considerably more accurate in 1965.

For the last five months of the year, the raw sludge pumpage was greatly increased to prevent the further occurrence of odourous septic conditions in the primary clarifier. The installation of a new positive displacement pump, replacing a centrifugal pump, will allow a considerable reduction in the volume and an increase in concentration of the raw sludge, while still allowing greater control over the depth and condition of sludge in the primary clarifier. This pump was placed in operation in early 1965.

The digested sludge removed from the digester was placed in drying beds on the plant property until July. These beds were abandoned in favour of liquid sludge haulage in an attempt to reduce odour complaints from nearby residents.

Gas production averaged 114,070 cubic feet per month and was a slight increase from the 1963 production.

CHLORINATION

MONTH	PLANT FLOW (MG)	POUNDS CHLORINE	DOSAGE RATE (P.P.M)
JANUARY	16.386	393	2.40
FEBRUARY	9.075	406	4.47
MARCH	15.057	422	2.80
APRIL	15.126	425	2.81
MAY	15.429	482	3.12
JUNE	* 14.760	595	4.03
JULY	* 15.252	1161	7.61
AUGUST	* 15.252	1178	7.72
SEPTEMBER	* 14.760	1201	8.14
OCTOBER	14.322	1089	7.60
NOVEMBER	17.170	927	5.40
DECEMBER	17.535	874	4.98
TOTAL	180.124	9153	-
AVERAGE	15.010	763	5.08

* meter out of service
Flows prorated on 244 days at .492mgd.

COMMENTS

Year-round chlorination of the final effluent was practiced. Chlorine is applied to the effluent at a rate sufficient to create a residual chlorine value of .5 ppm after 15 minutes contact time. For the months of July, August, September and October, chlorine was also introduced into the raw sewage in an effort to reduce odour problems at the plant. As a result, the average monthly use of chlorine was doubled for this period.

CONCLUSIONS

This report has outlined in detail the operational data for this plant during the past year. Odours which were a problem during the summer of 1964 were greatly reduced by the efforts of the plant staff, OWRC head office staff and the Local Advisory Committee. The same or improved methods of operation in 1965 should keep odours to a minimum.

RECOMMENDATIONS

It may be necessary to pre-treat some industrial wastes during 1965 to eliminate odours from the raw sewage entering the plant. With normal sewage and proper plant operation, odours should not occur; however, any strong sewage that becomes septic while flowing to the plant will cause odours in the primary treatment works.

Pre-treatment of industrial wastes will also reduce the organic loading on the plant and will extend its useful life.


ONTARIO WATER RESOURCES COMMISSION